trusion of solid masses and other phenomena connected with stratigraphical structure.

Here we have only just arrived at the end of the first volume of the present issue. The second volume begins in the middle of Book IV., with a continuation of the description of the manner in which the earth's crust has been built up and modified. This second part, however, refers to the action of internal heat and pressure, that is to say, it deals with rocks of igneous origin, whether superficial or deep-seated, and this leads to the consideration of earth movements, without which we should be unable to examine such rocks at all. Incidentally he here describes the mode of formation of veins and lodes.

Book V. gives a series of very much condensed, but still very useful notes on fossils and their place and use in geological investigations. This might be greatly extended.

Then follows in Book vi. the whole of systematic stratigraphy.

Our author arranges the stratified rocks under fifteen heads, and treats of their general characters, their flora and fauna, and their local development at home and abroad; but this, again, our author could easily develop into at least five volumes, representing the five groups under which the whole of historical geology could be very conveniently arranged.

In the seventh and last book he deals with the geographical features of the earth's surface, as affected by its geological character, and the arrangement of the materials of which it is composed.

There are buried in this text-book an immense number of facts vastly interesting to the general reader, and especially to the traveller who goes about with his eyes open, but without knowledge to follow the processes by which nature brings about the wonderful results observed. For instance, how seldom he realises when he sees the great blocks of travertine, so commonly used for building in Rome, that this *lapis Tiburtinus,* modified by Italian lips into travertino, is not a rock built up by the same kind of sediment as that of which most of the building stones he has seen elsewhere are composed, but that it is carbonate of lime which has been thrown down from chemical solution, and that plants have helped to collect it, while another similar rock, as commonly used elsewhere, has been collected by small animals, particle by particle, out of the sea water in which it was dissolved. Or if he is looking at those marvellous relics of volcanic activity, the geysers, which heap up silica instead of carbonate of lime, he will find that there also a small confervoid alga helps to collect the pasty material which afterwards hardens into flint. These are examples of scientific facts which would not force themselves upon the observation of the ordinary tourist, but which it would greatly add to his enjoyment of travel to know. Or, to take another more abstruse example, the study of the earth's satellite has suggested that the scars and pits upon it are due to the impact of aggregations of matter, and a similar bold hypothesis has been offered in explanation of certain depressions upon the earth. A basin-like hollow among the sandy mounds of Arizona was caused, it was suggested, by the impact of a meteoric body now possibly buried out of sight below, while the basin of the Atlantic, according to others, marks the area from which the material of the moon broke away from its moorings and commenced its long spiral spin round the earth. Such flights of imagination have often given us working hypotheses, which after pruning and shaping have found a place among the explanations of the order of the world. While we welcome all such tentative interpretations of phenomena, we must carefully weigh the evidence adduced, and not too hastily say proven or not proven.

The work is encyclopædic in character and arrangement, and, but that, alas! the question of cost has to be taken into consideration, we should gladly welcome its appearance in a dozen or more goodly volumes, the contents of which would be suggested by its present division into Books, some of which, as we have suggested, might be expanded into more than one volume. Then we might ask for larger type, instead of as now, 800 words to a page, and also for many more of the author's own clever sketches, and more illustrations such as those he has so judiciously selected from other sources.

NEW TEXT-BOOKS OF GEOMETRY.

Practical Plane and Solid Geometry. By I. H. Morris and J. Husband. Pp. viii + 254. (London: Longmans, Green and Co., 1903.)

First Stage Practical Plane and Solid Geometry. By G. F. Burn. Pp. viii + 240. (London: W. B. Clive, University Tutorial Press, Ltd., 1903.) Price 2*s.*

Examples in Practical Geometry and Mensuration. By J. W. Marshall, M.A., and C. O. Tuckey, M.A. Pp. xii + 70. (London: George Bell and Sons, 1903.)

Elementary Geometry. Section ii. By Frank R. Barrell, M.A., B.Sc. Pp. viii + 169 to 284. (London: Longmans, Green and Co., 1903.) Price 1*s.* 6*d.*

Theoretical Geometry for Beginners. Part ii. By C. H. Allcock. Pp. viii + 123. (London: Macmillan and Co., Ltd., 1903.) Price 1*s.* 6*d.*

Notes on Analytical Geometry. By A. Clement Jones. Pp. iv + 172. (Oxford: Clarendon Press, 1903.) Price 6*s.* net.

Elementary Graphs. By W. M. Baker, M.A., and A. A. Bourne, M.A. Pp. iv + 34. (London: George Bell and Sons, 1903.) Price 6*d.* net.

TEXT-BOOKS in this country which deal with the practical applications of geometry naturally follow the South Kensington division of the Board of Education, a department of the public service which has always taken a leading part in the spread of this branch of knowledge. The department has two distinct syllabuses, one for the guidance of art classes, the other for science. Both syllabuses have quite recently been revised and considerably extended, and are well abreast of the times. Although the two schemes have parts in common, there is an increasing tendency for them to develop along divergent lines. Thus for art students one section of geometry to which great attention is paid is that relating to decorative geometrical designs, the study of which requires the drawing of many inscribed and circumscribed figures, patterns, &c. For science students this branch is of comparatively little interest. On the other hand, the geometry of vectors, a subject of first importance in science, has little attraction for the artist. Again, a student of science finds great use for his graphical constructions in the making of numerical computations, and the subject for him is becoming more quantitative in character. It is thus inadvisable to compile a text-book which shall endeavour to meet the wants of both classes of students; the first two books under review are written for science classes, and are adapted to the first stage of the revised South Kensington syllabus in Science Subject I.

The text-book by Messrs. Morris and Husband contains a large number of problems (more than 300) in plane and solid geometry, the solution of each being described in detail. The diagrams are clear and well printed, and are conveniently arranged to face the text. Each chapter closes with a useful collection of exercises. The syllabus is very completely covered as regards the matter, but the method of treatment cannot be said to correspond with its spirit. The student is told everything in minute detail. He is not sufficiently encouraged to think and invent for himself, and it is difficult to see how his interest can be maintained and his mental faculties properly developed. The method employed in problem 123 is obviously incorrect, and will no doubt be altered at the first opportunity.

In the volume by Mr. Burn, it is evident that the author's main interest centres in solid geometry, and he teaches this branch of the subject well, the student being instructed how to make simple models for himself, these being effectively used along with drawing in order to obtain a good grasp of this somewhat difficult subject. Too little attention seems to be given to plane geometry, and the student is not well grounded therein. The treatment of vectors is also meagre, and displays an inadequate conception of the scope and importance of this portion of the subject. Unfortunately some of the diagrams are needlessly small, and are trying to the eyesight.

The remaining five volumes are concerned principally with theoretical geometry. The book by Messrs. Marshall and Tuckey is a collection of nearly 550 examples arranged in groups. "The examples on practical geometry are intended primarily to lead up to geometrical reasoning, and only secondarily to give manual dexterity." Many of the examples are associated with a rider (distinguished by italic type), the truth of which will become evident as the figure is drawn, and which the reader is asked to establish by deductive reasoning. We notice with satisfaction that Euclid's method for the common tangents to two circles is discarded as unpractical. The examples in mensuration might with advantage have been a little more experimental. For instance, it would have been a satisfaction to a student to verify the numerical value of π; and an example might have been inserted asking for the area of a circle, to be obtained by the method of counting squares. The table of four figure logarithms which the authors give will prove very useful. We think that a simple table of functions of angles should also have been inserted and made use of in connection with some of the examples, especially those in mensuration. Teachers will find this large collection of examples very convenient, but its value would be enhanced by a further development on modern lines.

The second instalment of Mr. Barrell's "Elementary Geometry" comprises portions of Euclid ii., iii., iv. and vi., with some additional matter. In few of the recent text-books on the subject are the advantages of the reform in geometrical teaching more conspicuous than in this volume. While adhering to a strictly logical sequence, the author uses his new freedom to very good purpose, illustrating the propositions by experimental work, by well selected concrete examples, and by the employment of arithmetic, algebra and trigonometry. The introduction of the sine, cosine and tangent in the admirable chapter on ratio and proportion, and the subsequent judicious use of these functions, is a very good feature. The book deserves to be extensively used, and the appearance of section iii. of the work, which is in preparation, will be awaited with interest.

The first part of Mr. Allcock's geometry (corresponding with Euclid i.) was published in the early part of the year. The work is now continued, and the present part contains the equivalent of Euclid iii., 1–34, and iv., 1–9, with some additional propositions, such as the properties of the nine-point circle, and some practical applications and exercises. The title of the book correctly describes its contents and scope, comparatively little attention being given to quantitative and experimental graphical work. For those who do not wish to be tied to Euclid's sequence, and yet who desire to retain a strictly deductive system, the book will be found eminently suited. It is well written and beautifully printed; it contains a large number of easy deductive exercises distributed throughout its pages; and at the end of the volume there is a collection of practical exercises requiring numerical answers, which are given.

Mr. Clement Jones's text-book is intended for students who, having already taken an ordinary course in elementary analytical conics, wish to continue their studies and to obtain a good working knowledge of the methods of analytic research. In establishing the numerous properties of conics, the elementary theory of equations is applied in a systematic and thorough manner, in connection with which extended use is made of the single variable in the equations to the lines and curves. In a final chapter an account is given of cubic curves, the same powerful and illuminating method being employed. At the end of the volume the student will find a very useful collection of more than 200 examples, mostly taken from university examination papers, and the answers to these, with hints for solution, are appended.

The use of squared paper by schoolboys is becoming universal, and Messrs. Baker and Bourne have done well to issue separately the chapter on graphs from their recent text-book of elementary geometry. The subject is well introduced, and the young readers are led on by easy stages and well selected examples. In connection with the plotting of sines, cosines and tangents, a short table of these functions, from which the pupils could take out their own values, would have been very instructive if it could have been provided. It seems a pity that no mention is anywhere made of the slope of a curve; comparatively few persons have yet recognised that the practice of graphing affords a valuable opportunity of helping to put into more tangible shape the idea of a *rate* which is certainly possessed in a greater or less degree even by the very young.

A CAMBRIDGE TEXT-BOOK OF PHYSICS.

Electricity and Magnetism. By R. T. Glazebrook, M.A., F.R.S. Pp. viii+440; diagrams. (Cambridge: University Press, 1903.) Price 7*s.* 6*d.*

THE present work represents a first-year course of Dr. Glazebrook's lectures in electricity and magnetism when at Cambridge. It forms one member of a series of which "Mechanics," "Heat," and "Light" have already appeared. The issue of these manuals was undertaken in response to a request that his lectures might be printed for the use, primarily, of the students attending the practical classes at Cambridge. Thus Dr. Glazebrook rather apologetically explains the publication of another book dealing with elementary electricity.

It is true that the number of elementary text-books is legion, and a man may well hesitate before adding to their number. Yet we think that there is still room, and that if a book of superlative value appears it will not fail to find a welcome.

In attempting to estimate whether the present volume is a noteworthy addition to elementary literature, let us in the first place say that it has undoubtedly many excellences. The method followed throughout is that with which we are already familiar in the other members of the series.

This method consists in mingling the theoretic and experimental sides of the subject, so that in no place is a student very far from the experimental point of view. Many of the experiments are intended apparently to be done only by the lecturer, but fifty-seven are specially described as instructions to a student. This double method involves considerable repetition, as the same statement which is made in the general text often appears again in the description of the experiment. No doubt, however, Dr. Glazebrook has found by experience that a junior student can hardly be told a thing too often, and repetition certainly does not err on the side of indefiniteness. Again, there is a considerable amount of repetition in the text itself. A general induction is made from some experiment, and this leads to a definition. The definition in many cases consists only of a repetition of the previous statements in a rather more formal shape. This, again, may be an advantage from the student's point of view, but it must be admitted that it tends to make the book rather slow. We cannot imagine anyone (except a reviewer) taking it up and reading until the small hours before putting it down. However, it is essentially a class book, and the student may acquire an enthusiasm for science from his teacher, who will amplify the somewhat categorically imparted information, hence the lack of more life is not so important.

The statements made are usually clear and logical. In some cases we are not sure of the logic. Thus, take the following sentence:—

> "We have already seen that the electrification of a conductor may be the manner in which we recognise a state of stress set up in the dielectric round the conductor" (p. 40).

Should not the logic of this sentence be inverted? Is it not the stress in the medium which is directly investigated, and from which the state of electrification is inferred?

Again, in stating the law of electric force, it is asserted to follow

> "as a result of the experiments, that when two similarly charged bodies are at a distance apart which is great compared with their dimensions, there is a repulsion between them which is proportional to the product of their charges," &c. (p. 44).

Is it not more logical to say that we measure the electric charges of bodies as being proportional to the mechanical forces which arise in consequence of them?

Again, the "joule" is *defined* in terms of electrical quantities. This reversal of the true logical order will mislead the student, who will fail to see that it is a purely mechanical quantity.

These may seem merely finicking criticisms, but those of us who come largely into contact with students know how difficult it is to eradicate illogical notions acquired during their early training.

In some cases the information given is not sufficient. Thus, while considerable use is made of lines of force, we are not told how they are drawn so as to represent the *intensity* of the field.

Again, the lines in the diagrams on pp. 36, 37, are drawn on a completely different system from those on pp 38, 39, and there is no hint given of this. Of course, to the ordinary student this does not matter—he is accustomed to consider physics an esoteric science; but how confusing to the real student who tries to make out what the diagrams mean.

Again, *tubes* of force suddenly appear (without introduction) on p. 186 instead of lines.

On p. 377 it is stated that

> "the total E.M.F. round the secondary is proportional to the total change in the number of lines of induction linked with it."

The whole chapter on electromagnetic induction, indeed, deals only with the total E.M.F. It is nowhere defined—the student will think it identical with electromotive force.

The figures are very good and instructive. Fig. 77, which shows the screening action of an iron ring, would be improved if the *refraction* of the lines at the surface of the iron were correctly represented. Again, the lines do not crowd between the cake and cover